receiving new notifications that identify new changes to the contact information. At a subsequent synchronization, the client provides only the collection and tokens from the new notifications back to the server.

Thus, the principles of the present invention allow for data to be synchronized between a message server and a message client even if the server and the client represent the same data in a different manner. Furthermore, as mentioned above, when the server and client represent the same data in a different manner, it is difficult to determine whether the different data structures do indeed represent the same data by resorting to a field-by-field comparison. Thus, in conventional systems, the user is often prompted to intervene when the server could not make the determination. The present invention eliminates this requirement thereby making synchronization much more user friendly, especially when data is represented differently by the server and client.

The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims are to be embraced within their scope.

What is claimed and desired to be secured by United States Letters Patent is:

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1. In an environment that includes a first device storing first data and a second device storing second data, a method of synchronizing the second data with the first data, while accounting for one or more update notifications that either may or may not have been received by the second device and while accounting for any differences in how the first device and second device store data, the method comprising:

an act of making a change in the first data;

an act of sending a notification to the second device, the notification including both the change and a token identifying the change;

an act of receiving a synchronization request from the second device; and

an act of resending the change to the second device if the synchronization request does not include the token.

2. A method as recited in claim 1 wherein the act of resending the change to the second device includes the act of resending the token to the second device.

3. A method as recited in claim 1 wherein the act of sending a notification is performed over an unreliable communication channel.

4. A method as recited in claim 3 wherein the unreliable communication channel comprises a wireless communication channel.

5. A method as recited in claim 3 wherein the acts of receiving a synchronization request and resending the change are performed over a reliable communication channel.

6. A method as recited in claim 1 wherein the token is unique to the first device.

7. A method as recited in claim 1, further comprising the act of compressing the token, wherein the compressed token is unique to the second device.

8. A method as recited in claim 1 wherein the first and second data include at least one of contact data, calendar data, task data, and email data.

9. A method as recited in claim 1 wherein the first device comprises a message server and the second device comprises a message client.

10. A method as recited in claim 9 wherein the message client comprises one of a portable personal computer, a cellular telephone, a pager, and a personal digital assistant.

11. A method as recited in claim 1 wherein the notification corresponds to only a portion of the change made in the first data, the method further comprising the act of providing, in response to a request for synchronization that includes the token, any remaining portion of the change made in the first data.

12. In an electronic messaging environment that includes a message server and one or more message clients, a method of synchronizing data stored at the one or more message clients with data stored at the message server, while accounting for one or more update notifications that either may or may not have been received by the one or more message clients and while accounting for any differences in how the message server and the one or more message clients store data, the method comprising:

an act of making a plurality of changes in the message server data;

an act of generating a plurality of tokens identifying each of the plurality of changes in the message server data;

an act of sending a plurality of notifications to the one or more message clients over an unreliable communication channel, each notification including (i) at least one of the plurality the changes and (ii) at least one of the plurality of tokens, the at least one of the plurality of tokens corresponding to the at least one of the plurality of changes;

an act of receiving a plurality of tokens back from the one or more message clients;

an act of interpreting one or more tokens that were sent to the one or more message clients but not received back from the one or more message clients as indications that one or more changes are missing from the one or more message clients; and

an act of resending the one or more missing changes to the one or more message clients.

13. A method as recited in claim 12, further comprising the act of resending to the one or more message clients one or more tokens identifying the one or more missing changes.

14. A method as recited in claim 12 further comprising:

an act of generating a collection object that comprises a list of tokens, the list representing a state of the data stored at the one or more message clients; and

an act of sending the collection object to the one or more message clients.

15. A method as recited in claim 12 wherein the unreliable communication channel comprises a wireless communication channel.

16. A method as recited in claim 12, further comprising the act of compressing the plurality of tokens, wherein the act of compressing the plurality of tokens produces a plurality of tokens that are unique to each of the one or more message clients.

17. A method as recited in claim 12 wherein the data stored at the message server includes at least one of contact data, calendar data, task data, and email data and wherein the one or more message clients comprise one of a portable personal computer, a cellular telephone, a pager, and a personal digital assistant.

1   18. A method as recited in claim 12 wherein at least one change made in the

2   message server data is divided into a first portion and a second portion, and at least one

3   notification corresponds to the first portion, the method further comprising:

4   an act of receiving back from the one or more message clients, a token

5   associated with the first portion; and

6   an act of sending the second portion to the one or more message clients in

7   response to receiving back the token associated with the first portion.

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19. In an electronic messaging environment that includes a message server and one or more message clients, a method for synchronizing data stored at the one or more message clients with data stored at the message server, while accounting for one or more update notifications that either may or may not have been received by the one or more message clients and while accounting for any differences in how the message server and the one or more message clients store data, the method comprising:

a step for providing, over an unreliable communication channel, a plurality of notifications to the one or more message clients, the plurality of notifications including (i) a plurality of changes to the data stored at the message server, and (ii) a plurality of tokens identifying each of the plurality of changes;

a step for determining whether or not the one or more message clients are missing any of the plurality of notifications based on whether or not the one or more message clients can provide back each of the plurality of tokens identifying each of the plurality of changes; and

a step for providing to the one or more message clients, any change associated with a missing notification identified in the step for determining.

20. A method as recited in claim 19 wherein the unreliable communication channel comprises a wireless communication channel.

21. A method as recited in claim 19 further comprising a step for providing a collection object to the one or more message clients, the collection object representing a state of the data stored at the one or more message clients.

22. A method as recited in claim 19 wherein the step for providing any change associated with a missing notification further comprises a step for providing any token associated with a missing notification.

23. A method as recited in claim 19 further comprising an act of compressing the plurality of tokens to produce tokens that are unique to each of the one or more message clients.

24. A method as recited in claim 19 wherein the data stored at the message server includes at least one of contact data, calendar data, task data, and email data and wherein the one or more message clients comprise one of a portable personal computer, a cellular telephone, a pager, and a personal digital assistant.

25. A method as recited in claim 19 wherein at least one change made in the message server data is divided into a first portion and a second portion, and at least one notification corresponds to the first portion, the method further comprising a step for providing the second portion to the one or more message clients in response to receiving a token associated with the first portion.

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26. In an electronic messaging environment, a system for synchronizing data, while accounting for one or more update notifications that either may or may not have been received by the one or more message clients and while accounting for any differences in how the message server and the one or more message clients store data, the system comprising:

a message server storing data;

one or more message clients storing data;

an unreliable communication channel at least intermittently connecting the message server and the one or more message clients; and

processor means for performing the acts of:

making a plurality of changes in the message server data;

generating a plurality of tokens identifying each of the plurality of changes in the message server data;

sending a plurality of notifications to the one or more message clients over the unreliable communication channel, each notification including (i) at least one of the plurality the changes and (ii) at least one of the plurality of tokens, the at least one of the plurality of tokens corresponding to the at least one of the plurality of changes;

receiving a plurality of tokens back from the one or more message clients;

interpreting one or more tokens that were sent to the one or more message clients but not received back from the one or more message clients as indications that one or more changes are missing from the one or more message clients; and

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resending the one or more missing changes to the one or more message clients.

27. A system as recited in claim 26 further comprising processor means for performing the acts of:

generating a collection object that comprises a list of tokens, the list representing a state of the data stored at the one or more message clients; and

sending the collection object to the one or more message clients.

28. A system as recited in claim 26 wherein the unreliable communication channel comprises a wireless communication channel.

29. A system as recited in claim 26 further comprising processor means for resending one or more tokens identifying the one or more missing changes.

30. A system as recited in claim 26 further comprising processor means for compressing the plurality of tokens, wherein the processor means produces a plurality of tokens that are unique to each of the one or more message clients.

31. A system as recited in claim 26 wherein the data stored at the message server includes at least one of contact data, calendar data, task data, and email data and wherein the one or more message clients comprise one of a portable personal computer, a cellular telephone, a pager, and a personal digital assistant.

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32. A system as recited in claim 26 wherein at least one change made in the message server data is divided into a first portion and a second portion, and at least one notification corresponds to the first portion, the system further comprising processor means for performing the acts of:

receiving back from the one or more message clients, a token associated with the first portion; and

providing the second portion to the one or more message clients in response to receiving back the token associated with the first portion.

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33. A computer program product for use in an electronic messaging environment that includes a message server in communication with one or more message clients, the computer program product for implementing a method of synchronizing data stored at the one or more message clients with data stored at the message server, while accounting for one or more update notifications that either may or may not have been received by the one or more message clients and while accounting for any differences in how the message server and the one or more message clients store data, the computer program product comprising a computer-readable medium having computer-executable instructions for performing the acts of:

identifying a plurality of changes in the message server data;

generating a plurality of tokens identifying each of the plurality of changes in the message server data;

causing to be sent, a plurality of notifications to the one or more message clients over an unreliable communication channel, each notification including (i) at least one of the plurality the changes and (ii) a at least one of the plurality of tokens, the at least one of the plurality of tokens corresponding to the at least one of the plurality of changes;

accumulating a plurality of tokens back from the one or more message clients;

interpreting one or more tokens that were sent to the one or more message clients but not received back from the one or more message clients as indications that one or more changes are missing from the one or more message clients; and

causing to be resent, the one or more missing changes to the one or more message clients.

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34. A computer-program product as recited in claim 33 wherein the computer-readable medium further comprises computer-executable instructions for performing the acts of:

generating a collection object that comprises a list of tokens, the list representing a state of the data stored at the one or more message clients; and

causing to be sent, the collection object to the one or more message clients.

35. A computer-program product as recited in claim 33 wherein the computer-readable medium further comprises computer-executable instructions for performing the acts of causing to be resent one or more tokens identifying the one or more missing changes.

36. A computer-program product as recited in claim 33 wherein the computer-readable medium further comprises computer-executable instructions for performing the acts of compressing the plurality of tokens, wherein the computer-executable instructions produce a plurality of tokens that are unique to each of the one or more message clients.

37. A computer program product as recited in claim 33 wherein the computer-executable instructions of the computer-readable medium process data stored at the message server that includes at least one of contact data, calendar data, task data, and email data.

38. A computer-program product as recited in claim 33 wherein at least one change made in the message server data is divided into a first portion and a second portion, and at least one notification corresponds to the first portion, the computer-readable medium further comprising computer-executable instructions for performing the acts of:

receiving back from the one or more message clients, a token associated with the first portion; and

providing the second portion to the one or more message clients in response to receiving back the token associated with the first portion.